

RPX Repeater Series™

Installation and User Guide



Models RPU2160/RPU4160

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RADIO FREQUENCY (RF) EXPOSURE SAFETY STANDARD



Caution

Before using this product, read the operating instructions and RF energy awareness information contained in the Product Safety and RF Exposure booklet (Motorola P/N 68007024074) enclosed with your radio.

!

To ensure compliance to RF Energy Safety Standards:

- Install only Motorola approved antennas and accessories
- Be sure that Product Safety and RF Safety Booklet (P/N 68007024074) enclosed with this radio is available to the end user upon completion of the installation of this radio

For a list of Motorola-approved antennas and other accessories, visit the following web site which lists approved accessories for your radio model:
<http://www.motorola.com/RPX>

OPERATIONAL SAFETY GUIDELINES

1. Read these instructions.
2. Keep these instructions.
3. Heed all warnings.
4. Follow all instructions.
5. Do not use this apparatus near water.
6. Clean only with a damp cloth.
7. Do not block any of the ventilation openings. Install in accordance with the manufacturer's instructions.
8. Do not install near any heat sources such as radiators, heat registers, stoves, or other apparatus (including amplifiers) that produce heat.
9. Do not defeat the safety purpose of the polarized or grounding-type plug. A polarized plug has two blades with one wider than the other. A grounding type plug has two blades and a third grounding prong. The wide blade or the third prong are provided for your safety. When the provided plug does not fit into your outlet, consult an electrician for replacement of the obsolete outlet.
10. Protect the power cord from being walked on or pinched particularly at plugs, convenience receptacles, and the point where they exit from the apparatus.
11. Use only the attachments/accessories specified by the manufacturer.
12. Use only on a stable, flat surface or install using the wall mount holster that comes with this product. When a cart is used for transporting this device, use caution when moving the cart/apparatus combination in order to avoid injury from tip-over.
13. Unplug this apparatus during lightning storms or when unused for long periods of time.
14. Refer all servicing to qualified service personnel. Servicing is required when the apparatus has been damaged in any way, such as power-supply cord or plug is damaged, liquid has been spilled or objects have fallen into the apparatus, the apparatus has been exposed to rain or moisture, does not operate normally, or has been dropped.
15. The power supply is not suitable for outdoor use. Use only in dry locations/conditions.
16. Connect the power supply only to an appropriately fused and wired supply of the correct voltage (as specified on the product).

17. Disconnect the power supply from the line voltage by removing the main plug. The outlet to which this equipment is connected should be nearby and easily accessible.
18. Maximum ambient temperature around the power supply equipment must not exceed 40°C (104°F).
19. Make sure that the cord is located where it will not be stepped on, tripped over, or subjected to water, damage or stress.

FCC LICENSING INFORMATION

INTERFERENCE INFORMATION

This device complies with Part 15 of the FCC Rules. Operation is subject to the condition that this device does not cause harmful interference.

The RPX Repeater Series™ operate on radio frequencies that are regulated by the Federal Communications Commission (FCC). To transmit on these frequencies, you are required to have a license issued by the FCC. Application is made available on

FCC Form 601 and Schedules D, H, and Remittance Form 159.

When using portable hand held units with this repeater, please note that there is an output power limitation according to FCC's rule part 90.267. This regulation limits the maximum output power of portable units to 2 W when used with a repeater operating on frequencies in the 450 – 470 MHz band allocated for Industrial/Business use.

To obtain these FCC forms, request document 000601 which includes all forms and instructions. If you wish to have the document faxed, mailed or have questions, use the following contact information.

Faxed contact the Fax-On-Demand system at:	Mailed call the FCC forms hotline at:	For questions regarding FCC license, contact the FCC at:
1-202-418-0177	1-800-418-FORM 1-800-418-3676	1-888-CALL-FCC 1-888-225-5322 Or: http://www.fcc.gov

Before filling out your application, you must decide which frequency(ies) you can operate on: “Appendix A: Repeater Specifications” on page 61. For questions on determining the radio frequency, call Motorola Product Services at: **1-800-448-6686**.

Changes or modifications not expressly approved by Motorola may void the user's authority granted by the FCC to operate this radio and should not be made. To comply with FCC requirements, transmitter adjustments should be made only by or under the supervision of a person certified as technically qualified to perform transmitter maintenance and repairs in the private land mobile and fixed services as certified by an organization representative of the user of those services.

Replacement of any transmitter component (crystal, semiconductor, etc.) not authorized by the FCC equipment authorization for this radio could violate FCC rules.

Use of this radio outside the country where it was intended to be distributed is subject to government regulations and may be prohibited.

Notes

INTRODUCTION

Congratulations on your Motorola® RPX Repeater Series™ purchase!

This repeater is a product of Motorola's 80 plus years of experience as a world leader in the designing and manufacturing of communications equipment. The RPX Repeater Series™ provide cost-effective communications for businesses such as retail stores, restaurants, schools, construction sites, manufacturing, property and hotel management and more. Motorola Business Radios and Repeater devices are the perfect communications solution for all of today's fast-paced industries.

Note: Read this user guide carefully to ensure you know how to properly operate the repeater before use.

PACKAGE CONTENTS

Your product package contains the following products and manuals:

- Repeater (includes the Alkaline Battery Frame)
- Antenna
- Power Supply
- Wall holster mount
- User Guide, CD and Quick Reference Leaflet
- Warranty Card
- Product Safety & RF Exposure Booklet

For product information, visit us at:
www.motorola.com/radios/business
or visit our micro-site at: www.motorola.com/RPX

For User Guide or product-related questions, contact:

1-800-448- 6686 in the USA
1-800-461-4575 in Canada
1-866-522-5210 on your TTY (Text Telephone)

You can also send mail to us at:

**Business Radios,
RPSD 1C15, Motorola
8000 West Sunrise Boulevard
Plantation, Florida 33322**

ABOUT THIS MANUAL

This manual contains installation information required for the RPX Repeater Series™ repeaters.

SERVICE SUPPORT

For information related to the service support (including software, replacement parts and accessories for the RPX Repeater Series™), contact your Motorola Authorized Distributors and Resellers via MOL (Motorola On-Line Tool).

For all other inquiries about service information, please call your Motorola Point of Contact or call:

1-800-448-6686 in the USA
1-800-461-4575 in Canada
1-866-522-5210 on your TTY (Text Telephone)

PRODUCT SAFETY

For information related to RF Exposure compliance and Batteries and Chargers Safety, please refer to "Radio Frequency (RF) Exposure Safety Standards" on page v.

MANUAL REVISIONS

Changes may occur after this manual is printed. To obtain an updated or latest version of this manual, please go to: <http://www.motorola.com/RPX>

ACRONYMS

The explanations in this manual will be using the following acronyms:

AC: Alternate Current

DC: Direct Current

RX: Receiving Frequency

TX: Transmitting Frequency

CX: Connected

DX: Disconnected

RF: Radio Frequency

P/N: Part Number

Table 1: RPX Repeater Series™ Models

Label Model	Frequency Band	Output Power	Number of Channels	Battery Default Type
RPU2160	UHF	2 W	16	Alkaline
RPU4160	UHF	4 W	16	Alkaline

REPEATER OVERVIEW

PARTS OF THE REPEATER

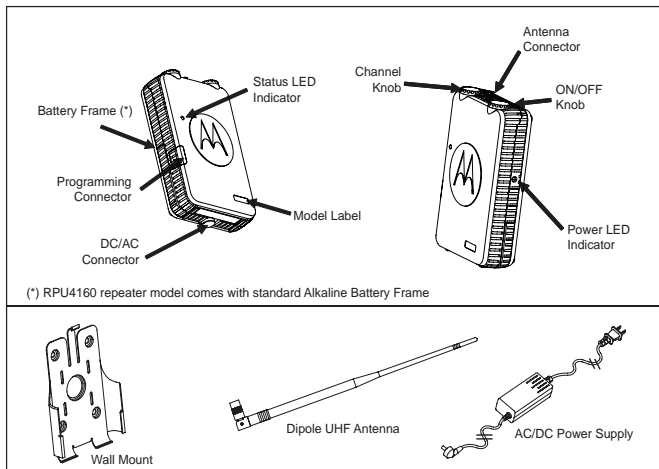


Figure 1. Repeater Parts

Repeater Parts

The repeaters are compatible with 2 - way repeater capable business radios. Please refer to "Programming Your Radios" on page 43 for more information on how to program the RDX radios to work with the repeater. For RDX radio model information details, please contact your Motorola Point of Sale.

1. On/Off Knob

Use to turn the repeater ON or OFF.

2. Channel Selector Knob

Use to switch the repeater for up to 16 different channels. Please refer to "Getting Started" on page 33 for more information.

3. Model Label

Indicates the model of the repeater.

4. Antenna

Removable UHF 450 – 470 dipole antenna. Please refer to "Repeater Installation" on page 18 for more information.

5. Status LED Indicator

Use to indicate, among others, repeater's power up and transmission status. Please refer to the "Getting Started" on page 33 for more information.

6. Power LED Indicator

One side LED indicator gives repeater AC/DC connection status whenever the repeater is working on alkaline Battery Frame (standard repeater model). Two LED side indicators give AC/DC connection and charging status whenever the repeater is working on Li-Ion Battery Frame. Please refer to "Alkaline Batteries Frame Solution" on page 30 for more information.

7. AC/DC Connector

Use to connect the AC/DC power supply.

8. Programming Connector

Use to connect the repeater to a PC in order to program. (CPS Programming Cable (P/N RKN4155) required). Please refer to the "Programming The Repeater" on page 38 for more information.

9. Alkaline Battery Frame

The repeaters' standard package includes the Alkaline Battery frame. Refer to "Alkaline Battery Frame" on page 30 for more information.

10. Repeater Power Supply

The repeaters are equipped with AC/DC power supply to connect the repeaters to AC or DC power sources.

Repeater Accessories

The repeaters include different types of accessories that are sold separately. Please refer to the "Accessories" on page 59 for more information.

1. Lithium-Ion (Li-Ion) Battery Frame

Li-Ion Battery Frame (P/N HKHN4004A) allows the use of high capacity Li-Ion batteries in giving up to 16 hours of battery back up operation.

2. Antenna, Magnetic Mount and RF Cable Kit

The repeaters' accessories offers an Antenna/Magnetic Mount/RF Cable Kit (P/N HKKN4022). This external antenna accessory is strongly recommended in order to allow the repeater antenna to have a better coverage. Please refer to "Repeater Installation" on page 18 for more information.

3. Vehicle Car Power Supply Adaptor

For your convenience, the repeaters' portfolio includes a Vehicle Adaptor (also known as "Cigarette Lighter Adaptor" P/N HKPN4003). Please refer to "Outdoor Installations Considerations" on page 28 for more information.

4. Repeater Software (CPS)

The repeaters offer the convenient capability of customizing your repeater features by using the CPS (Computer Programming Software). Please refer to the "Programming The Repeater" on page 38 for more information. For Software download information, contact your Motorola Distributor or Reseller.

Repeater General Applications

The repeaters are ideal as a **range extender**, that can help reach other users in areas that are normally not covered by a 2-way radio's range. They are also very useful to help resolve the common problem of the “**dead spots**” that are created when there are terrain obstructions (like hills or trees), concrete building structures or architectural designs that interfere with the radio signal⁽¹⁾.

The repeaters are designed to satisfy both 810 Mil spec as well IP55 (*) level water and dust ingress protection. This rugged device can stand harsh environments⁽²⁾ making it ideal for outdoors operations. Its light weight and various back-up power options (like alkaline/Li-Ion Batteries Frames and Vehicle Adaptor) make this repeater a perfect portable solution for temporary outdoor applications.

The repeaters operate in the UHF 450 – 470 MHz band providing 16 channels⁽³⁾ with different pre-programmed settings. This particular feature allows easy and quick in field repeater deployment whenever there is need to setup more than one repeater for different users' groups.

Fully and easily programmable, the repeaters give the flexibility to customize frequencies, codes and other features according to specific needs⁽⁴⁾.

A key advantage for the repeaters is that the radios have been designed to be compatible with the UHF RDX 2-way, repeater capable radios. Enjoy the convenience of picking up RDX accessories (high capacity batteries, chargers and programming cables) and re-use them with your repeaters. This clever inter operability feature will allow you also to get the most out of your complete radios and repeater system solution by offering cloning and programming among radios and repeaters.



Figure 2a. Repeater Application Example – Indoors



Figure 2b. Repeater Application Example – Outdoors

Note: (1) The repeaters work best when located in an ideal place that can have good reception for re-transmitting the signal without any problems. Refer to "Pre-Installation Considerations" on page 10 for more information.

(2) The repeaters are not submersible devices (Refer to "Appendix A: Repeater Specifications" on page 61 for more information) and it is NOT an FM (Factory Mutual) certified device.

(3) Out of the 16 pre-programmed channels that are available out of the box, you can select only ONE channel each time you TX/RX with the repeater. The repeaters are NOT multi-channel repeaters.

(4) The repeaters' CPS software is required. Refer to "Programming The Repeater" on page 38 for more information.

How the Repeater Works

The repeater allows 2-way radios, base stations or call boxes to communicate through the repeater in order to extend the coverage range and/or overcome dead communication spots.

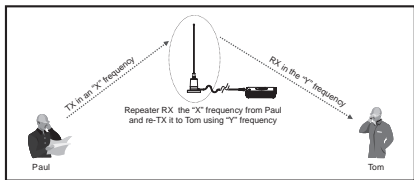


Figure 3a. How the Repeater Works (TX)

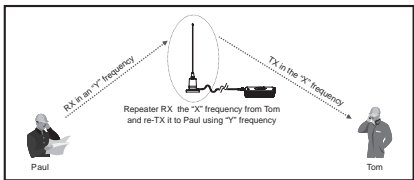


Figure 3b. How the Repeater Works (RX)

In the Figure 3a, the repeater will get the signal "X" that Paul transmits from his radio and will convert it into a "Y" frequency that will re-transmit to Tom. In Figure 3b, when Tom answers back to Paul, his radio will also use the "X" frequency to transmit. The repeater will do the same frequency conversion ("X" to "Y") and will re-transmit it to Paul using frequency "Y".

Not only Paul and Tom will be able to communicate using "X" and "Y" frequencies, but so will all other 2-way, repeater capable radios that may be in the area* working on those same frequencies settings.

Note: The repeater needs to re-transmit in a different frequency from what it received in order to avoid interferences.

The following are estimations of the repeaters' talk coverage range with the repeater located indoors. Refer to Table 3 "Repeater Alkaline Frame Power LED (Side)" on page 31 and "Figure 4. Estimated Outdoors Coverage Range" on page 9 for more information.

Table 2: Estimated Talk Range

Model	Industrial	Outdoors
	Inside steel/concrete industrial buildings	Line of sight/No obstructions
UHF 2 W	Up to 420,000 square feet	14 miles
UHF 4 W	Up to 600,000 square feet	9 miles

Note: These are estimated maximum ranges that assume ideal location, environmental and terrain conditions for the repeater operation.

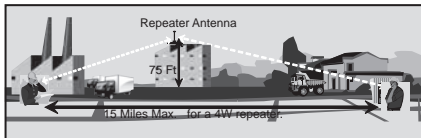


Figure 4. Estimated Outdoors Coverage Range

As seen in Figure 4, the maximum antenna height for low power fixed stations is limited to 23 meters (75 feet) above ground. For stations operating at fixed locations for temporary periods, the antenna height is limited to 7 meters (20 feet) above ground.

Note: Proper programming of the repeater (Refer to "Programming The Repeater" on page 38 section for more information) and optimal repeater antenna location are the most important factors that will determine the coverage and quality of your repeater communications. It is highly recommended to refer to "Pre-Installation Considerations" on page 10 before proceeding to install the repeater. Make sure your 2-way radios are repeater capable (able to manage separate TX and RX frequencies for the same channel). Refer to "Programming The Repeater" on page 38 for more information.

PRE-INSTALLATION CONSIDERATIONS

Proper repeater installation ensures the best possible performance and reliability of the repeaters. Pre-installation planning is required to make sure you take into account.

- RF coverage field test to decide mounting location of the repeater in relation to input power and antennas
- Site Environmental Conditions
- Electrical Requirements
- Proper programming of the repeater's parameters (in order to assure interoperability with other radio devices). 'Programming The Repeater' on page 38 for more information.

Note: You must read the entire pre-installation chapter in order to assure proper repeater operation.

RF Coverage Field Test

The following instructions* are quick and easy tips to test the RF coverage area and decide the best position for the Repeater Antenna (either with the antenna directly installed into the repeater device or using the antenna/magnetic mount/ RF cable accessory kit (P/N HKKN4022).

This field coverage test will need to be performed by at least two people, each one with a fully charged 2-way radio. Before the test, make sure the radios are programmed exactly on the same parameters (frequencies, codes, bandwidth, etc.) and are operating in talk around mode.

Note: (*) These instructions are not intended to replace a professional RF field test.

Choosing a Tentative Location

Prior to the RF coverage field test, you must first decide which would be the tentative locations for the repeater. You should have different options that will be evaluated according to the following aspects:

- Location should be as centered as possible to the area that is being intended for coverage so the signal strength is at the same level as possible for all points.
- If the repeater is to be located inside a building, for example, try to look for a height vertically centered location as well.
- Location should meet minimum environmental requirements. (Please refer to 'Environmental Conditions at Intended Installation Site(*)' on page 14 for more information).

- If you are planning to use the repeater to cover a large area with different buildings, it is strongly recommended that you use the antenna/magnetic mount and RF Cable Accessory Kit to install the repeater antenna in a high point that allows as much as possible line of sight (**) to most of the area to be covered. Bear in mind that most of the times, increasing the repeater's antenna height will improve the coverage, but is not necessarily always the case.
- If you are planning to have an indoors installation for the repeater, double check that the environmental and electrical installation requirements described in the following sections are feasible.

Note: (**) Means sight from the repeater free of obstructions at the naked eye.

Conducting the RF Coverage Field Test

The objective of the field test is to “simulate” the transmission quality and coverage that the repeater may have based upon a chosen location. This type of testing and planning becomes very useful as it can save you extra work and money as a poor location and/or adverse environmental conditions can affect the repeater’s performance.

To do so, one person should remain in the tentative repeater location and the second person should start walking around the area intended to be covered, while transmitting with the radio.

If the quality communication between the two way radios is good, this will mean that the repeater transmissions should be OK.

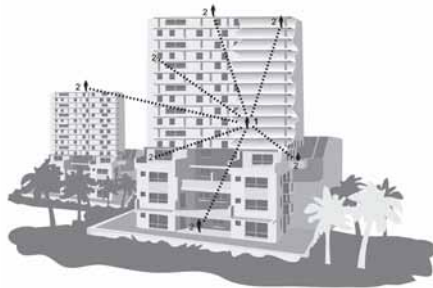


Figure 5: Conducting the RF Coverage Field Test

The test can be conducted by more than two people, as long as the first one remains fixed on the repeater location under evaluation.

Note: If you’re planning to have an external antenna installation, you should try to mimic, as much as possible, the antenna positioning to replicate the antenna’s height.

During this RF test coverage, one of the key field conditions to test are those spots that will be the most likely to be used for most of the people (indoors and/or outdoors) and those that may appear particularly challenging due to concrete/steel walls, building architecture, obstructions (like trees or vertical fire panels in ceilings or walls) and terrain shape. Make sure you walk around all those places in order to test reception and transmission signal strength.

Conduct the test transmitting preferably on those settings that you will plan to have your radios and repeater programmed(*). If possible, repeat the test using different frequencies and codes.

Note: (*) Remember TX range for the repeater is 450 – 455 MHz and RX range is 465 – 470 MHz.

If the reception coverage is below expectations, try changing the height of the antenna or the repeater location (do one change at a time so you can track what is really affecting the coverage) and repeat the field test coverage.

MULTIPLE REPEATERS IN A SINGLE LOCATION (MULTIPLE USER GROUPS)

As the repeaters have 16 different programmable channels to choose from for setting up the TX/RX frequency pairs, it is possible to configure multiple repeaters in the same location or around the same area.

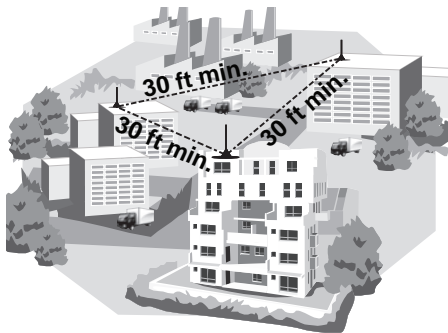


Figure 6. Multiple Repeaters installations (One User Group)

Whenever you need to expand the 2-way radios' coverage in the same area but for different user's groups, you can use multiple repeaters located at the same site. For ensuring that the different groups will not be interfering with each other and that each one will have their private communications, each repeater and the radios set must have different channel settings (please refer to 'Antenna Installation Instructions' on page 20 and 'Programming The Repeater' on page 38 for more information). Additionally, for this case, make sure the channel TX/RX frequency separations between the different repeaters is at least 1 MHz.

Note: For other requirements (environmental, electrical and mechanical), make sure you read sections ahead, especially information related to equipment ventilation.

Environmental Conditions at Intended Installation Site(*)

A key factor for repeater performance is to accurately evaluate the site environment where the repeater will be installed. Plan the installation, paying particular attention to environmental conditions at the site like temperature, humidity, dust and ventilation.

The repeater may be installed in any indoors location suitable for electronic communications equipment or outdoors temporary/semi-permanent installations, provided that the environmental conditions do not exceed the equipment specifications for temperature, humidity, and air quality according to Mil 810 and IP55 ruggedness specifications (For specification details, please refer to 'Appendix A: Repeater Specifications' on page 61).

Temperature Ranges

This is the temperature measured in close proximity to the repeater. For example, if the repeater is mounted in a cabinet, the temperature that is measured is within the cabinet.

This temperature threshold applies both for outdoors and indoors repeater operation.

Operating Temperature Range

-30°C (-22°F) to +60°C (+140°F)

Storage Temperature Range

-40°C (-40°F) to +85°C (+185°F)

Humidity & Water(*)

Do not to exceed 95% relative humidity (RH) @ (-30°C (-22°F) to +60°C (+140°F)).

Note: The Repeaters are IP55 water resistant devices, able to withstand water exposure for certain periods of time. Bear in mind that the repeaters are NOT submersible.

Ventilation

Also important is to make sure that there is adequate ventilation i.e. cabinets with ventilation slots (for air circulation), especially if multiple equipments are installed in the same room. In which case, a minimum distance of open space between the devices is recommended.

Note: (*) Please refer to 'Appendix A: Repeater Specifications' on page 61 for specification details.

ELECTRICAL REQUIREMENTS

AC/DC Power Requirements

The repeater comes equipped with a AC/DC power supply, that operates from 110 Vac to 240 Vac at 50 Hz to 60 Hz.

The outlet must be connected to an AC source capable of supplying a maximum of 280 W. For a nominal 110/120 Vac input, the AC source must be able to supply 5 A and should be protected by circuit breaker rated at 15 A. For a nominal 220/240 Vac input, the AC source must be able to supply 3 A and should be protected by a circuit breaker rated at 10 A.

The DC power requirement is 12 V (+/- 10%).

Note: The AC socket must be installed near the equipment and must be easily accessible. Consideration should be given to the connection of the equipment to the supply circuit and the effect that overloading of the circuits might have on over current protection and supply wiring. Appropriate consideration of equipment ratings should be used when addressing this concern.

Site Grounding and Lightning Protection



Caution

Proper site grounding and lightning protection are vitally important consideration, Failure to provide proper lighting protection may result in permanent damage to the repeater equipment. Please refer to 'Appendix B: Repeater Lightning Protection' on page 69 for basic instruction.

One of the most important considerations when designing a communications site is the ground and lightning protection system. Make sure installations meet all local and state building codes in you area.

Electrical Ground

Ground wires carrying electrical current from circuitry or equipment at the site is included in the category of electrical ground. Examples include the AC or DC electrical power used to source equipment located at the site, and wires or cables connected to alarms or sensors located at the site.

RF Ground

This type of ground is related to the transmission of the radio frequency energy to earth ground. An example of RF grounding is the use of shielding to prevent or at least minimize the leakage of unwanted RF transmissions from communications equipment and cables.

Lightning Ground

Providing adequate lightning protection is critical to a safe reliable communications site. RF transmission cables, and AC and DC power lines must all be protected to prevent lightning energy from entering the site building.

Although a comprehensive coverage of the site grounding technique and lightning protection is not within the scope of this instruction manual, there are several excellent industry sources for rules and guidelines on ground and lightning protection at communications site.

Note: Motorola recommends the following reference source: "Motorola Quality Standards Fixed Network Equipment Installation Manual R56" P/N 6881089E50.

REPEATER INSTALLATION

For the explanations in this chapter, please refer to the “Parts of the Repeater” on page 3 under “Repeater Overview” for more information.

Repeater Positioning and Orientation

Once you have decided the repeater’s location, make sure you place it either on a flat and stable surface (outdoors or indoors), lying horizontal as shown in “Figure 7a. Repeater Orientation on a Flat Surface” on page 18 and “Figure 7b. Repeater Orientation Outdoors” on page 18 or mount it on a flat wall/ceiling surface.



Figure 7a. Repeater Orientation on a Flat Surface

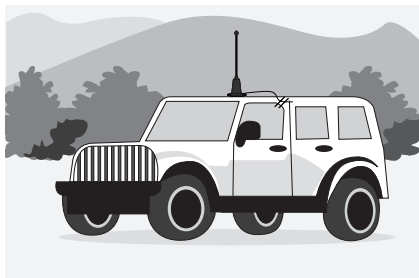


Figure 7b. Repeater Orientation Outdoors

The actual orientation of the repeater device itself shouldn’t have any impact on the repeater’s performance (given a non-obstructed antenna). However, when using the dipole antenna (P/N HKAE4000), make sure the antenna and power supply are in a straight line (2 to 3 feet minimum) as shown in “Figure 8a. Repeater Cable Layout Using Dipole Antenna P/N HKAE4000” on page 19. When using an external antenna (Antenna/Magnetic Mount Kit – P/N HKKN4022), make sure there is a minimum of 2 to 3 feet distance for both the power cable and RF cable to

run straight from the repeater in order to assure that performance is not deteriorated as shown in “Figure 8b. Repeater Cable Layout Using External Antenna P/N HKKN4022” on page 19.

Note: Double check that the Antenna’s cable doesn’t tangle either around the repeater device or the power supply. The power supply cord also shouldn’t tangle around the repeater device or antenna.

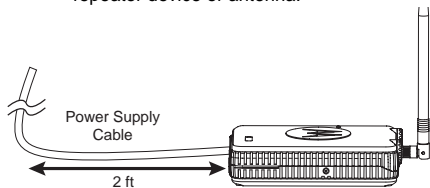


Figure 8a. Repeater Cable Layout Using Dipole Antenna P/N HKAE4000

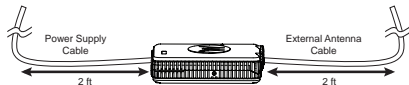


Figure 8b. Repeater Cable Layout Using External Antenna P/N HKKN4022

When positioning the repeater, make sure the repeater antenna is placed away from obstructions, metal structures or any objects or enclosures (like elevators) that can cause any type of shielding.

Antenna Installation Instructions

Repeater antenna installation is critical to the system performance. The approved Motorola antenna for the RPU4160 is the UHF Dipole Antenna P/N HKAE4000, (50 Ohm).

Attaching the Dipole Antenna to the Repeater

(Installing the dipole antenna directly onto the repeater is recommended whenever coverage range or obstructions are not an issue or/and the repeater is likely to be moved around to other sites).

1. Align the threaded end of the antenna with the repeater's antenna connector and turn the antenna bushing clockwise to fasten it. "Figure 9. Attaching Dipole Antenna to the Repeater (clockwise)" on page 20.

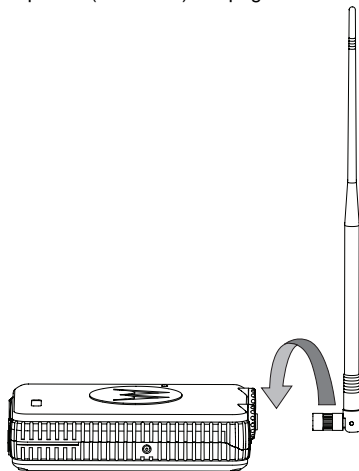


Figure 9. Attaching Dipole Antenna to the Repeater (clockwise)

2. Make sure the dipole antenna is mounted vertically (90 degrees) in reference to earth ground (either up or down). Please refer to “Figure 10a. Examples of Correct Dipole Antenna Orientation” on page 21 and “Figure 10b. Examples of Incorrect Dipole Antenna Orientation” on page 21 for examples of incorrect antenna positioning.

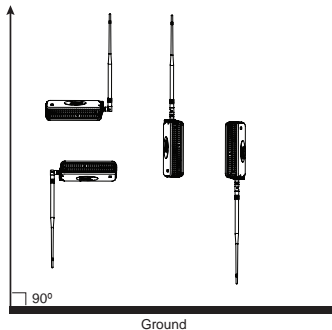


Figure 10a. Examples of Correct Dipole Antenna Orientation

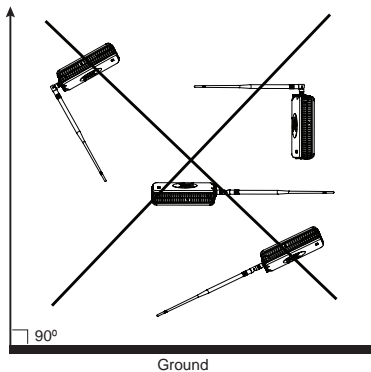


Figure 10b. Examples of Incorrect Dipole Antenna Orientation

Removing the Dipole Antenna from the Repeater

Turn the antenna bushing counterclockwise until you can remove it.

Installing External Antenna Using the Antenna/Magnetic Mount /RF Cable Kit Accessory

If as an outcome of the RF Coverage Test Field, (please refer to “Pre-Installation Considerations” on page 10) you decide that you will place the repeater antenna somewhere else (outdoors or indoors) away from the repeater device, you should then use the Antenna/Magnetic Mount and RF Cable accessory P/N HKKN4022.

Note: Always use Motorola approved accessories in order to assure performance and safety. Please refer to “Accessories” on page 59 for details.

Magnetic Mount Kit Installation

- Ideally the external antenna magnetic mount should be mounted on a metal surface or other area with similar material that allows the mount magnet to stick securely.

- When installing the exterior antenna into the magnetic mount, make sure the antenna is always in a vertical orientation (either straight up or straight down, 90° to ground). Avoid side or skewed antenna orientations as these positions can affect repeater performance (See examples in “Figure 11a. Examples of Correct Exterior Magnetic Mount Antenna Orientation” on page 23 and “Figure 11b. Examples of Incorrect Exterior Magnetic Mount Antenna Orientation” on page 23).
- Make sure the exterior antenna magnetic mount is installed and positioned away from obstructions like metal structures, concrete walls or any other objects that may cause signal shielding.

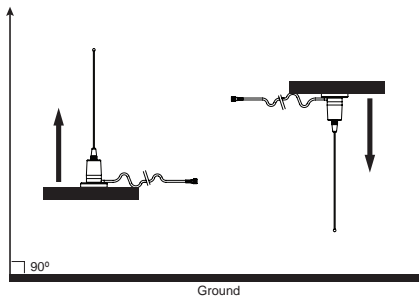


Figure 11a. Examples of Correct Exterior Magnetic Mount Antenna Orientation

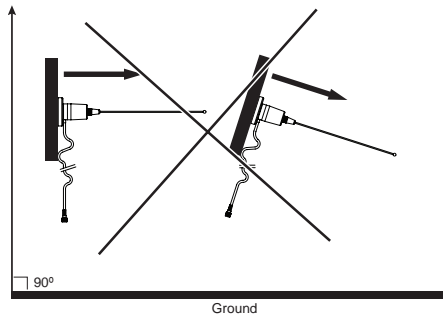


Figure 11b. Examples of Incorrect Exterior Magnetic Mount Antenna Orientation

RF Cable Installation

Note: The RF cable is 12 feet long. Keep this in mind when locating the repeater.

In order to attach the RF Cable to the Repeater (please refer to “Figure 12. Connecting RF Cable to Repeater” on page 24), simply:

1. Align the end of the RF Cable antenna bushing with the repeater’s RF antenna connector.
2. Turn the RF Cable bushing clockwise to fasten it.

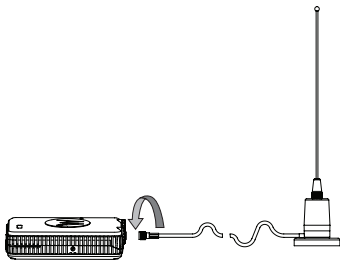


Figure 12. Connecting RF Cable to Repeater

When installing the RF cable make sure that:

- The RF Cable is taut.
- The RF Cable doesn't go around the magnetic mount antenna, antenna, the repeater device or the power supply cable as all these can cause electromagnetic interference (please refer to “Figure 11a. Examples of Correct Exterior Magnetic Mount Antenna Orientation” on page 23 and “Figure 11b. Examples of Incorrect Exterior Magnetic Mount Antenna Orientation” on page 23 for examples of wrong positioning).
- If the cable is routed through a ceiling or wall that connects outdoors, make sure there is an appropriate sealing around the cable to prevent water or other material from coming permanently into the repeater.



Important

Do not attempt to modify the RF cable from its original design in any way.

Installing Exterior Antenna

In order to install the exterior antenna into the magnetic mount, simply:

1. Align the threaded end of the antenna with the magnetic mount's mini UHF connector as shown on "Figure 13. Attaching Exterior Antenna into Magnetic Mount" on page 25.
2. Turn the antenna clockwise to fasten it.



Figure 13. Attaching Exterior Antenna into Magnetic Mount

Uninstalling Exterior Antenna

1. Turn counterclockwise in order to remove antenna from magnetic mount.



Caution

It is important that all antenna cables are grounded at the point they enter the building.

Wall Mount Installation Instructions

The wall mount is recommended for permanent or semi-permanent indoors repeater installation.

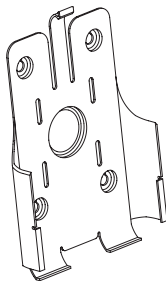



Figure 14a. Wall Mount Holster

To install the wall mount:

1. The wall mount holster is designed to be capable of mounting to a wall or any other similar flat surface via screws, straps or single bolt. (If you choose to use screws, make sure you secure them tightly on each one of the wall mount corners).

 <p>Important</p>	<p>Remember not to install the repeater on or near conductive or shielding surfaces.</p>
---	--

2. Once the wall mount is firmly secured to a surface, slide the repeater device from top to bottom of the holster ("Figure 14b. Installing the Wall Mount Holster" on page 26) until the repeater clicks in place into the wall mount rails.
3. Proceed to connect antenna and power supply cables.

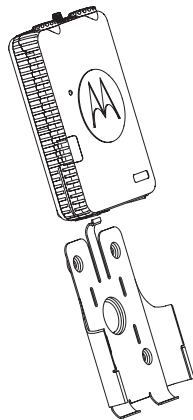


Figure 14b. Installing the Wall Mount Holster

AC/DC Power Supply Connection

Each repeater ships standard with an AC/DC Power supply cord (P/N PMPN4002A)(9 feet long) that connects the repeater to a (110/120)/(220/240) Vac source.

Nominal Input: (110/120)/(220/240) Vac at 60/50 Hz.

Average output voltage: 12 Vdc with 2.5 Amp (at maximum load).



Important

When operating the power supply, make sure that the maximum input current never exceeds 0.8 Amp at 100 Vac and ambient temperature is between -30°C to 60°C. Provide over voltage/current protection in order to avoid unsafe operating conditions.

To connect AC/DC power supply:

1. Plug the AC/DC power supply into an AC power source of 110/220 V or a 12 V DC power and route it to the Repeater Jack labeled “AC/DC IN”.

Note: The cable from the power supply should be routed in a straight line and should not tangle, go around or wrap around the repeater device, the antenna or the RF Cable. See “Figure 8a. Repeater Cable Layout Using Dipole Antenna P/N HKAE4000” on page 19 (Notice in this picture that the cable must be laid down straight for at least 2 feet).

Outdoor Installations Considerations

- The RPX repeaters are suitable for *temporary* outdoors operations under environmental conditions that meet the Mil Specifications 810 and IP55 (designed to meet level of water ingress and dust protection). For details, please refer to “Appendix A: Repeater Specifications” on page 61.

Outdoors Repeater Temporary Installation – Example

- The repeater outdoors installation example in “Figure 15a. Outdoors Temporary Repeater Installation Example” on page 28 shows the magnetic mount and RF cable installed on top of the car’s roof in order to secure the antenna against wind and allow repeater to be placed inside the car. This is a convenient configuration as the repeater can be protected against harsh weather as well as re-charged directly from the car battery * using vehicle adaptor P/N HKPN4003, without interrupting or reducing the repeater power output.

Note: The ideal repeater outdoors usage features the repeater working on back-up batteries. (The power supply is not designed for outdoor use).



Figure 15a. Outdoors Temporary Repeater Installation Example

Vehicle Adaptor

The repeaters offer the convenience of a Vehicle Adaptor accessory (P/N HKPN4003, sold separately) for the repeaters.




Figure 15b. Vehicle Adaptor

ALKALINE BATTERY FRAME

ABOUT ALKALINE BATTERIES

Please visit your Alkaline batteries' manufacturer website for information and guidelines regarding handling and disposal of Alkaline batteries.

 Important	Do not store alkaline batteries in a non-operating equipment for longer than 30 days.
---	---

Alkaline Batteries Frame Solution

The repeaters' standard package comes equipped with an Alkaline Battery Frame Solution, ("Figure 16a. Alkaline Battery Frame" on page 30 – alkaline batteries are not included).

When the repeater is using the Alkaline batteries as the backup power in the event of an AC/DC power absence or failure and there is an AC/DC power failure or absence, the repeater automatically switches to back-up mode from the alkaline batteries.

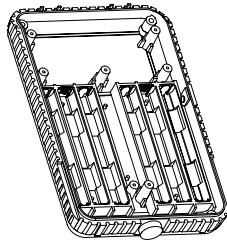



Figure 16a. Alkaline Battery Frame

Alkaline Battery Life Estimation

When the repeater is working on back-up alkaline batteries, the estimated battery life time (assumed fully charged) is 16 hours for both 2 W and 4 W models.

Whenever the 4 W repeater is switched to work on battery back-up, the system will only transmit at 2 W.

 Important	The 4 W repeater will automatically switch to 2 W output power whenever it detects that there is no AC/DC input. It will then operate on back-up battery.
---	---

Alkaline Battery Power LED (Side LED)





 Important	Do not attempt to recharge alkaline batteries. They are non-rechargeable.
---	---

Table 3: Repeater Alkaline Frame Power LED (Side)

Status	LED Status	AC/DC Status	Comments
No Batteries Detected	 Red (Slow) Blinking	CX	When the battery frame is empty or the batteries are dead
Batteries Detected	 Steady Red	CX	Batteries are good and in place
OFF	 OFF	DX	When AC/DC is disconnected, the LEDs will be OFF

CX: Connected to AC/DC **DX:** Disconnected from AC/DC

Note: Alkaline Battery Frame is also available as a stand-alone accessory (P/N HKHN4003).

Installing/Removing the Alkaline Battery Frame

1. Turn OFF the repeater if it is turned ON.
2. Disconnect AC/DC Power.
3. Use a Phillips screwdriver to remove the four corner screws located at each corner on the back of the repeater, disconnect power harness and lift away the repeater back battery frame. "Figure 16b: Installing the Alkaline Battery Frame into/from the Repeater" on page 31.

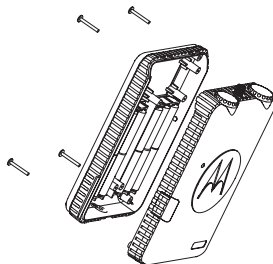


Figure 16b: Installing the Alkaline Battery Frame into/from the Repeater

4. Arrange alkaline batteries to match each of the alkaline frame batteries' polarity (+ or -) markings and slide them into each one of the alkaline battery frame compartments. Repeat until 12 batteries have been properly placed. Plug in the power harness. "Figure 16c: Installing the Alkaline Batteries" on page 32.

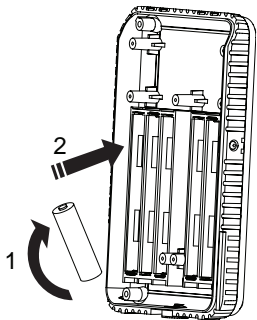


Figure 16c: Installing the Alkaline Batteries

5. Make sure the repeater's internal cable is connected between the repeater and the battery frame.

6. Assemble the alkaline battery frame (loaded with the alkaline batteries) into the back of the repeater by tightening securely the four screws on each of the four corners on the back of the repeater. Please refer to "Figure 16b: Installing the Alkaline Battery Frame into/from the Repeater" on page 31.



Important


When securing back the alkaline frame lid into the repeater, it is very important to make sure the screws are tightened firmly to preserve the sealing of your repeater. Failing to do so can negatively impact the repeater's IP55 water and dust resistant feature.

LI-ION BATTERY FRAME (OPTIONAL ACCESSORY)

The repeaters are capable of operating with Li-Ion batteries. The Li-Ion Battery Frame, P/N HKHN4004 is sold separately as an accessory.

GETTING STARTED

TURNING REPEATER ON/OFF

 Caution	<p>Never transmit without having a transmit antenna connected to the TX antenna jack of the repeater.</p>
---	---






1. Turn the ON/OFF knob clockwise to turn on the repeater. The repeater front LED will blink a red light for 3 seconds.

REPEATER STATUS LED (FRONT LED)






Table 4 "Repeater Status LED Indicator (Front LED) " on page 33 shows the repeater LED status summary:

Radio LED Indicators

Table 4: Repeater Status LED Indicator (Front LED)

MODE	LED STATUS	
Transmit		Solid Red
Receive (RX)		Solid Green
Idle		Red (Slow) Blinking
Power Up		Solid Red 2 – 3 seconds
Transmit Low Power		Solid Orange

**Table 4: Repeater Status LED Indicator
(Front LED) (Continued)**

MODE	LED STATUS	
Low Battery Shutdown		Orange (Fast) Blinking
Low Battery		Orange Blinking
Fatal Error at Power Up		1 Green Blink, 1 Orange Blink, 1 Green Blink, then repeat
Unprogrammed Channel		Double Red (Slow) Blinking
Non-Repeater Channel Mode		1 Red Blink, 1 Green Blink, then repeat

SELECTING A CHANNEL

The repeaters offer 16 different channels from which you can choose ONE channel at a time for the repeater to operate. To select a channel, rotate the Channel Selector Knob until you reach the desired channel. Each channel has its own pre-

programmed Frequency, Interference Eliminator Code and Bandwidth Settings. Please refer to the following table for factory default values details:

Table 5: Repeater Channels Default Settings

Channel #	Transmit Band 450 – 455 Mhz		Common Parameters			Receive Band 465 – 470 Mhz–	
	Frequency (TX) Index #	Frequency (TX) Mhz	Code (Index #)	Code Value (Hz)	Bandwidth	Frequency (RX) Index #	Frequency (RX) Mhz
1	65	451.1875	1	67	12.5 KHz	34	466.0375
2	66	451.2375	4	77	12.5 KHz	35	466.0625
3	67	451.2875	8	88.5	12.5 KHz	36	466.0875
4	68	451.3375	29	179.9	12.5 KHz	37	466.1125
5	69	451.4375	0	none	12.5 KHz	38	466.1375
6	70	451.5375	1	67	12.5 KHz	39	466.1625
7	71	451.6375	6	82.5	12.5 KHz	40	466.1875
8	72	452.3125	10	94.8	12.5 KHz	41	466.2125

Table 5: Repeater Channels Default Settings (Continued)

Channel #	Transmit Band 450 – 455 Mhz		Common Parameters			Receive Band 465 – 470 Mhz	
	Frequency (TX) Index #	Frequency (TX) Mhz	Code (Index #)	Code Value (Hz)	Bandwidth	Frequency (RX) Index #	Frequency (RX) Mhz
9	74	452.4125	29	179.9	12.5 KHz	42	466.2375
10	75	452.5125	0	0	12.5 KHz	50	467.8625
11	76	452.7625	3	74.4	12.5 KHz	51	467.8875
12	77	452.8625	5	79.7	12.5 KHz	52	467.9125
13	65	451.1875	7	85.4	12.5 KHz	53	469.4875
14	66	451.2375	9	91.5	12.5 KHz	54	469.5125
15	72	451.3125	11	97.4	12.5 KHz	55	469.5375
16	74	452.4125	13	103.5	12.5 KHz	56	469.5625

In order to modify these default values, you should use the CPS Software. Please refer to "Programming The Repeater" on page 38 for more details.

REPEATER PROGRAMMING DEFAULT VALUES

"Programmable Features Default Values" on page 37 shows the default factory values that the repeater has pre-programmed. These values can only be customized by using the CPS software.

Table 6: Programmable Features Default Values

Repeater Features Default Values		
Feature	Values	Default
TX Timeout	1, 2 or 3 minutes	1 minute
TX Hangtime (or Carrier Delay)	Off to 50 seconds	5 seconds
Courtesy Beep	ON or OFF	OFF
Repeater ID	15 minutes, 30 minutes, after TX hangtime, or OFF	15 minutes
On Battery Back-Up	OFF, 15 minutes, 30 minutes, 45 minutes, 60 minutes	30 minutes
Low Battery TX	0 to 255 minutes	10 minutes
Number of Channels	1 to 16	16
Reverse Burst	180 to 240	180
TX Power	Low (2 W) or High (4 W)	High – 4 W
TX BW	12.5 or 25.0 KHz	12.5 KHz
RX BW	12.5 or 25.0 KHz	12.5 KHz

PROGRAMMING THE REPEATER

PROGRAMMING FEATURES OVERVIEW

The repeaters are fully programmable devices that provide features customization by using the CPS* (Computer Programming Software).

The CPS allows to program frequencies and Codes (either from a pre-loaded frequency default list table or allowing to enter directly any customized value) as well as other features such as Bandwidth, Hang Time-out, Repeater ID Timer, Courtesy Beep timer, Transmit Time Out Timer, Reverse Burst, among others.

One of the key advantages of the CPS is the flexibility to quickly and easily program and clone several repeaters using a customized profile. The CPS also provides security by giving the option to set up a codeplug password for profile repeater's management (CPS Manager Lock).

Please refer to the CPS software HELP File (under "Content and Index") where you will find the details and explanations for each one of the repeater's programmable features.

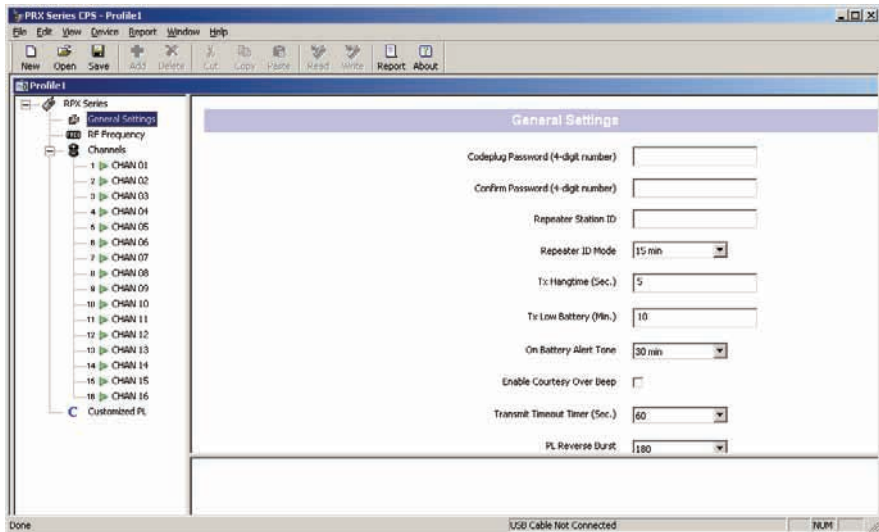


Figure 17. Example of the CPS Repeater Interface

Note: Contact your Motorola distributor or reseller in order to get information on how to get a copy of the CPS software.

Programming the Repeater Using the CPS

Before you begin programming the repeater make sure you have available:

- A PC (Windows® XP, Windows 2000 compatible, Vista)
- CPS Programming Cable (sold separately as an accessory P/N RKN4155),
- CPS* Software installed
- Repeater batteries are charged or repeater is connected to a AC/DC power line.

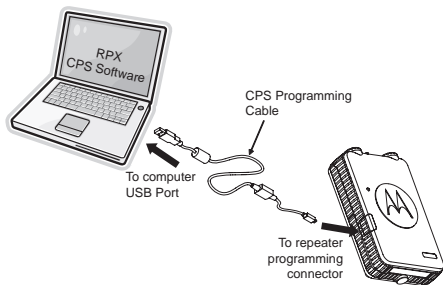


Figure 18. Programming the Repeater Using the CPS



Important

Please notice that this CPS Programming cable's mini-connector should not be used for connecting devices other than the RDX Series chargers (RLN6304/RLN6375) and the repeaters.

How to Read and Modify Your Repeater's Features

1. Ensure you have installed the latest CPS in your computer.
2. Turn the repeater OFF.
3. Plug the CPS Programming Cable P/N RKN4155 into the Repeater's programming connector. "Figure 18. Programming the Repeater Using the CPS" on page 40.
4. Connect the other end of the CPS cable into your computer 's USB port.
5. Open your CPS software and turn your repeater ON.
6. Click "read" icon in the upper bar menu.

Note: The "read" icon is grayed-out until the computer detects the CPS Programming Cable.

7. When the CPS reads the repeater successfully, you will see a window pop up showing a bar progress icon indicating the repeater's profile is being read.

Note: You will now be able to read and modify all your repeater features with the options available in the left side menu in your profile window . For more details on how to read, write or modify radio features, please refer to the **CPS Help Menu → Content and Index**. Detailed information about how to clone the repeater's profile is also available in the **CPS Help Menu → Content and Index → Cloning Repeaters**.

CPS Connection Trouble Shooting

Table 7: Programming Mode: Trouble Shooting

Symptom	Try This
CPS doesn't read the repeater or write to the repeater	Make sure the CPS cable is securely connected on both ends (programming port in the repeater and USB port in the computer)/Make sure your repeater hasn't run out completely of battery power or is connected to an AC/DC supply/Make sure the CPS cable is not damaged.
CPS displays "Error: Communication Error" when trying to read or write to the repeater	Make sure your repeater is ON/Double check that the repeater model matches your CPS version and region as they should be compatible in order to read and write. For checking your CPS version, click in the "about" icon in the upper tool bar.
CPS displays "your repeater doesn't match your region"	Double check that the radio model matches your CPS version and region as they should be compatible in order to read or write. For checking your CPS version, click on the "about" icon in the upper tool bar.
When trying to clone the repeater, the CPS displays an error or the cloning fails	Please refer to "Cloning Repeaters" in the CPS Help File for details on cloning details.

PROGRAMMING YOUR RADIOS

PROGRAMMING YOUR RDX 4 W RADIOS TO WORK WITH THE REPEATERS

RDX 4 W series radios are fully compatible with your repeaters as they are of the same UHF band and they support repeater capability features. However, in order to configure the radios to communicate with the repeater, there are basic tips that you should take into account:

- Make sure the channels in both the RDX radios and the repeaters that you want to use with the repeater capability are actually enabled in the CPS with a “check” box looking as follows:

General Settings
RF Frequency
Channels

- ... 1 ▶ CHAN 01
- ... 2 ▶ CHAN 02
- ... 3 ▶ CHAN 03
- ... 4 ▶ **CHAN 04**
- ... 5 ▶ CHAN 05
- ... 6 ▶ CHAN 06
- ... 7 ▶ CHAN 07
- ... 8 ▶ CHAN 08
- ... 9 ▶ CHAN 09
- ... 10 ▶ CHAN 10
- ... 11 ▶ CHAN 11
- ... 12 ▶ CHAN 12
- ... 13 ▶ CHAN 13
- ... 14 ▶ CHAN 14

CHAN 04 (4)

Name

Receive	Transmit
Frequency (MHz) <input type="text" value="4 - 451.337500"/>	Frequency (MHz) <input type="text" value="20 - 466.112500"/>
Bandwidth (KHz) <input type="text" value="12.5"/>	Bandwidth (KHz) <input type="text" value="12.5"/>
PL/DPL Code <input type="text" value="29 - 179.9 Hz"/>	Repeater Power <input type="text" value="High"/>
	PL/DPL Code <input type="text" value="29 - 179.9 Hz"/>

Repeater

Figure 19. Enabling Repeater capability settings

- Make sure the TX frequency and PL Code in the radio channel that has been chosen for repeater, is the same as the RX frequency in the repeaters. Same for the RX frequency in your RDX radio: make sure it matches the TX frequency and PL code in the repeaters channel.
- The repeaters have 16 channels available, each one with two TX/RX frequency pairs. You can either use the repeater default programmed frequencies and customize the RDX channels to match the repeater's or you can customize the repeater frequencies to different frequencies pairs to match frequency in the RDX radios.

Note: Take into account that when matching channel frequencies between the repeater and the radios, you must also need to make sure all other channel parameters (i.e. codes, bandwidth and reverse burst) are at the same correspondent values in order for the radios-repeater communications to take place properly.

REPEATER CLONING

RDX RADIO TO REPEATER CLONING

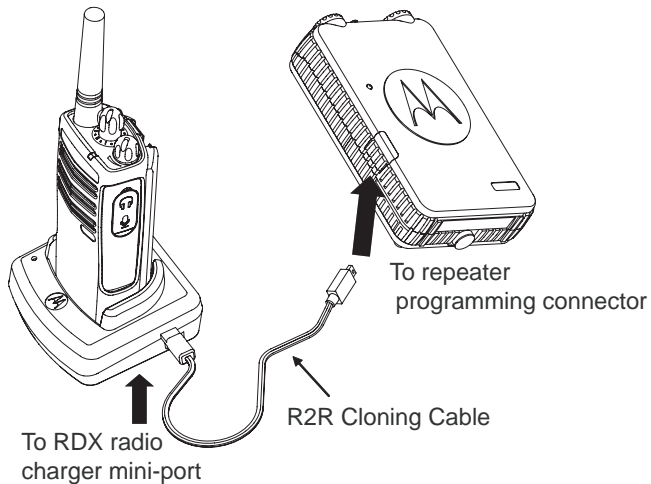


Figure 20. Cloning from an RDX radio into the Repeater

OPERATING INSTRUCTIONS

Below are instructions on how to clone your RDX 2 W / 4 W radio into one of the repeaters.

Note: It is NOT possible to clone the repeaters into the RDX radio.

The only parameters that can be cloned into the Repeater are:

- channel frequency,
- code,
- bandwidth,
- power,
- reverse burst,
- scan list
- the number of channels.

Before you start the cloning process, make sure you have the following components:

- Fully charged batteries on both the RDX radio and one of the repeaters
- One Single Unit Chargers (SUC) for the RDX Radio (either P/N RLN6304 or RLN6175)
- An RDX Radio to Radio (R2R) Cloning Cable P/N RLN6303

- An RDX Radio, repeater capable

CLONING INSTRUCTIONS

1. Turn OFF both the radio and the repeater.
2. Unplug any cables (power supply or USB cables) from the Single Unit Charger.
3. Plug one side of the cloning cable mini connector to the Single Unit Charger. Plug the other end to the Repeater programming port connector.

Note: During the cloning process, no power is being applied to the Single Unit Charger. The batteries will not be charged. A data communication is being established between the repeater and the radio.

4. Turn ON the repeater.
5. Power up the RDX radio following the sequence below:
 - Long press the PTT button and SB2 simultaneously while turning the radio ON.
 - Wait for 3 seconds before releasing the buttons until a distinctive audible tone is heard.

Note: After cloning is completed, the RDX radio will sound either a “pass” tone (cloning was successful) or a “fail” tone (cloning process has failed). The “pass” tone sounds like a good key “chirp” whereas the “fail” tone sounds similar to a “bonk” tone. If the RDX radio is a display model, it will either show “Pass” or “Fail” on the display (a tone will be heard within 5 seconds).

6. Once you have completed the cloning process, turn the RDX radio OFF and ON to exit ‘clone’ mode.
7. Turn the repeater OFF and ON to exit “clone” mode.

**Important**

- If the RDX channels contains frequencies that are not within the repeater TX or RX frequency range, the repeater will not work on these channels.
- In the RDX radio, make sure that in each one of the TX/ RX frequency pairs, the bandwidth setting has exactly the same value. For example, if in Channel 7 the TX bandwidth separation is 12.5 KHz, then the corresponding RX bandwidth separation in this same channel 7 should be also 12.5 KHz.

WHAT TO DO IF CLONING FAILS

The radio will emit an audible “bonk” indicating that the cloning process has failed. In the event that cloning fails, try performing each of the following tests before trying to start the cloning process again:

1. Ensure that the batteries on both radio and repeater are fully charged.
2. Check the cloning cable connection on both ends.
3. Ensure that the battery is engaged properly on to the RDX radio.
4. Ensure that the RDX radio is in cloning mode.
5. Ensure that the repeater is turned ON.

TROUBLESHOOTING

Symptom	Try This...
No Power	Recharge or replace the Li-Ion battery. Replace AA batteries. Reposition or replace AA batteries. Extreme operating temperatures may affect battery life. Verify repeater is connected to AC/DC.
Limited Talk Range	Steel and/or concrete structures, heavy foliage, buildings or vehicles decrease range. Check for clear line of sight to improve transmission. Verify repeaters and radios are correctly programed.
Transmissions are noisy and not clear	Make sure the radios are set up to 12.5 KHz bandwidth. Repeater is not fully compatible with radios using companding or set up at 25 KHz bandwidth.

Symptom	Try This... (Continued)
Message Are Not Received	Confirm that the radios have the same Channel, Frequency, Interference Eliminator Code and Scramble Code settings and are consistent with the Repeater's settings. Verify the range coverage is appropriate and there are no obstacles or shielding.
Heavy Static or Interference	Radios are too close to repeater; they must be at least five feet apart. Radios are too far apart from the repeater's antenna. Double check to make sure there are no obstacles interfering with
Low Batteries	Recharge or replace Li-Ion battery. Replace AA batteries. Extreme operating temperatures affect battery life.
Li-On Power LED Light Does Not Come On	Check if repeater's batteries are properly inserted and/or check battery/charger contacts to be sure they are clean and charging pin is inserted correctly.
Low Battery LED Blinking Although New Batteries Are Installed	Verify that the radio is set to the correct battery type and is well positioned into the battery frame according to instructions.

Symptom	Try This... (Continued)
Repeater Can't Receive or Can't Re-transmit/Radio Can Transmit But Can't Receive	Check repeater's programming settings versus radio's settings.
Battery Does Not Charge Although It Has Been Placed in the Li-On Battery Frame For A While	Check if the repeater is connected to the AC/DC power and is getting appropriate power. Check the charger LED indicators. Change the Li-ON batteries using an external charger to see if the batteries are damaged. Make sure the operating temperatures are within specific ranges.

Note:

The RPX Repeater Series™ are designed with a companding feature that is compatible with Motorola 2-way Business Radios. If you're working with a different radio and you experience static or noise in your communications, double check that the radios are capable of companding.

USE AND CARE



Use a soft damp cloth to clean the exterior



Do not immerse in water



Do not use alcohol or cleaning solutions

If the repeater is submerged in water...



Turn repeater OFF and remove batteries and antenna



Dry with soft cloth



Do not use repeater until completely dry

MOTOROLA LIMITED WARRANTY FOR THE UNITED STATES AND CANADA

What Does this Warranty Cover?

Subject to the exclusions contained below, Motorola, Inc. warrants its telephones, pagers, and consumer and business two-way radios (excluding commercial, government or industrial radios) that operate via Family Radio Service or General Mobile Radio Service, Motorola-branded or certified accessories sold for use with these Products ("Accessories") and Motorola software contained on CD-ROMs or other tangible media and sold for use with these Products ("Software") to be free from defects in materials and workmanship under normal consumer usage for the period(s) outlined below.

This limited warranty is a consumer's exclusive remedy, and applies as follows to new Motorola Products, Accessories and Software purchased by consumers in the United States, which are accompanied by this written warranty.

Products and Accessories

Products Covered	Length of Coverage
Products and Accessories as defined above, unless otherwise provided for below.	One (1) year from the date of purchase by the first consumer purchaser of the product unless otherwise provided for below.
Decorative Accessories and Cases. Decorative covers, bezels, PhoneWrap™ covers and cases.	Limited lifetime warranty for the lifetime of ownership by the first consumer purchaser of the product.
Business Two-way Radio Accessories	One (1) year from the date of purchase by the first consumer purchaser of the product.
Products and Accessories that are Repaired or Replaced.	The balance of the original warranty or for ninety (90) days from the date returned to the consumer, whichever is longer.

Exclusions

Normal Wear and Tear. Periodic maintenance, repair and replacement of parts due to normal wear and tear are excluded from coverage.

Batteries. Only batteries whose fully charged capacity falls below 80% of their rated capacity and batteries that leak are covered by this limited warranty.

Abuse & Misuse. Defects or damage that result from: (a) improper operation, storage, misuse or abuse, accident or neglect, such as physical damage (cracks, scratches, etc.) to the surface of the product resulting from misuse; (b) contact with liquid, water, rain, extreme humidity or heavy perspiration, sand, dirt or the like, extreme heat, or food; (c) use of the Products or Accessories for commercial purposes or subjecting the Product or Accessory to abnormal usage or conditions; or (d) other acts which are not the fault of Motorola, are excluded from coverage.

Use of Non-Motorola Products and Accessories.

Defects or damage that result from the use of Non-Motorola branded or certified Products, Accessories, Software or other peripheral equipment are excluded from coverage.

Unauthorized Service or Modification. Defects or damages resulting from service, testing, adjustment, installation, maintenance, alteration, or modification in any way by someone other than Motorola, or its authorized service centers, are excluded from coverage.

Altered Products. Products or Accessories with (a) serial numbers or date tags that have been removed, altered or obliterated; (b) broken seals or that show evidence of tampering; (c) mismatched board serial numbers; or (d) nonconforming or non-Motorola housings, or parts, are excluded from coverage.

Communication Services. Defects, damages, or the failure of Products, Accessories or Software due to any communication service or signal you may subscribe to or use with the Products Accessories or Software is excluded from coverage.

Software

Products Covered	Length of Coverage
Software. Applies only to physical defects in the media that embodies the copy of the software (e.g. CD-ROM, or floppy disk).	Ninety (90) days from the date of purchase.

Exclusions

Software Embodied in Physical Media. No warranty is made that the software will meet your requirements or will work in combination with any hardware or software applications provided by third parties, that the operation of the software products will be uninterrupted or error free, or that all defects in the software products will be corrected.

Software NOT Embodied in Physical Media.

Software that is not embodied in physical media (e.g. software that is downloaded from the internet), is provided “as is” and without warranty.

WHO IS COVERED?

This warranty extends only to the first consumer purchaser, and is not transferable.

WHAT WE WILL DO TO CORRECT WARRANTY PROBLEMS

At no charge to you, we have the option to repair or replace the Products or software that do not conform to the warranty, or to refund the Products’ purchase price. We may use functionally equivalent reconditioned/refurbished/pre-owned or new Products or parts. No software updates are provided.

HOW TO OBTAIN WARRANTY SERVICE OR OTHER INFORMATION?

Contact your Motorola point of purchase.

Please call:

1-800-448- 6686 in the USA

1-800-461-4575 in Canada

1-866-522-5210 on your TTY (Text Telephone)

You will receive instructions on how to ship the Products to Motorola. You must ship the Products to us with freight, duties and insurance prepaid.

Along with the Products you must include:

- (a) a copy of your receipt, bill of sale or other comparable proof of purchase;
- (b) a written description of the problem;
- (c) the name of your service provider (if this Product requires subscription service);
- (d) the name and location of the installation facility (if applicable) and, most importantly;
- (e) your address and telephone number. If requested, you must also return all detachable parts such as antennas, batteries and chargers.

RETAIN YOUR ORIGINAL PROOF OF PURCHASE.

We will ship repaired or replacement Products at our expense for the freight and insurance, but at your expense for any duties. If additional information is needed, please contact us at the telephone number listed above.

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PATENT NOTICE

This product is covered by one or more of the following United States patents.

5896277 5894292 5864752 5699006 5742484
D408396 D399821 D387758 D389158 5894592
5893027 5789098 5734975 5861850 D395882
D383745 D389827 D389139 5929825 5926514
5953640 6071640 D413022 D416252 D416893
D433001

EXPORT LAW ASSURANCES

This product is controlled under the export regulations of the United States of America. The Governments of the United States of America may restrict the exportation or re-exportation of this product to certain destinations. For further information contact the U.S. Department of Commerce.

ACCESSORIES

RPX REPEATER SERIES ACCESSORIES

ANTENNA ACCESSORIES

Part No.	Description
HKKN4022A	Antenna with MAG Mount & 12 foot RF Cable Kit
HKAE4000A	Dipole Antenna 438 – 470 MHz Kit

BATTERIES ACCESSORIES

Part No.	Description
HKHN4003A	RPX Repeater Series™ Alkaline Battery Frame
HKHM4004A	RPX Repeater Series™ Li-On Battery Frame

POWER SUPPLIES ACCESSORIES

Part No.	Description
HKPN4003A	Cigarette Lighter Vehicle Adaptor
TBD	AC/DC Repeater Power Supply

BATTERY ACCESSORIES

Part No.	Description
RLN6305	High Capacity Li-Ion Battery 2200 mAh
RLN6308	Ultra High Capacity Li-Ion Battery 2400 mAh
RLN6351	Standard Li-Ion Battery 1100 mAh
HKNN4010A	Ultra High Capacity Li-Ion Battery CR Kit
HKKN4011A	High Capacity Li-Ion Battery CR Kit

RDX PICK-UP RADIOS AND ACCESSORIES

CABLES ACCESSORIES

Part No.	Description
RLN6303	Radio to Radio Cloning Cable
RKN4155	CPS USB Programming Cable

CHARGER ACCESSORIES

Part No.	Description
RLN6304	Rapid Charger Kit
RLN6309	Multi-Unit Charger (MUC) Kit
RLN6175	Standard Drop-in Tray Charger

Note: For charging RDX radios and stand-alone Li-Ion batteries only.

2-WAY RDX REPEATER CAPABLE UHF RADIOS

Part No.	Description
RDU4160d	RDX UHF 4 W CH 2-Way Radio
RDU4100	RDX UHF 4 W CH 2-Way Radio

APPENDIX A: REPEATER SPECIFICATIONS

Product Specifications	UHF 25 KHz	UHF 12.5 KHz
FCC Id	TBD	TBD
IC Id	TBD	TBD
FCC Parts	Place Holder	TBD
Emission Designators	14K8F3E	11K1F3E
Operating RF Band (MHz)	450 – 470	450 – 470
Frequency Separation	10 – 20 MHz (Programmable)	10 – 20 MHz (Programmable)
TX Frequency Band	450 – 455 Mhz	450 – 455 Mhz
RX Frequency Band	465 – 470 Mhz	465 – 470 Mhz
Channel Spacing (narrow and wide band)	25 KHz	12.5 KHz
Mode of Operation	Duplex	Duplex
Code Signalling	Morse Code	Morse Code
Number of Operating Channels	1 (TX/RX) Channel	1 (TX/RX) Channel
Number of Software Programmable Channels/ Knob Channels	16	16
Synthesized Steps	1 Hz	1 Hz
Tone/Code Signalling	Morse Code	Morse Code

Product Specifications	UHF 25 KHz	UHF 12.5 KHz
Carrier Power Output (AC/DC) (Model Dependant)	2 W/4 W	2 W/4 W
Carrier Power Output on Batteries	2 W	2 W
Hang-Time Timer	From 0 (OFF) to 50 seconds programmed	From 0 (OFF) to 50 seconds programmed
Time-Out Timer	1, 2 or 3 minutes	1, 2 or 3 minutes
RF Connector	MIni UHF	MIni UHF
Cigarette Lighter Connector (Vehicle Adaptor)	Yes	Yes
Antenna Impedance	50 Ohms	50 Ohms
Duty Cycle	100%	100%
PL Codes	39+ Programmable	39+ Programmable
DPL Codes	84	84
Input Voltage -- Repeater	110/220 Vac +/- 10%	110/220 Vac +/- 10%
Input Voltage -- Transceiver	12 Vdc +/- 10%	12 Vdc +/- 10%
Input Current Repeater (@100 Vac)		
TX/RX Standby	230 mA	230 mA
	30 mA	30 mA
Input Current Transceiver (@ 12 Vdc)		
TX/RX Standby	1.6 A	1.6 A
	200 mA	200 mA

Product Specifications	UHF 25 KHz	UHF 12.5 KHz
Transmitter		
Frequency Range (MHz)	450 – 455 Mhz	450 – 455 Mhz
Carrier RF Output		
High	4.0 W	4.0 W
Low	2.0 W	2.0 W
Frequency Stability	+/- 1.0 PPM (-300°C – 600°C)	+/- 1.0 PPM (-300°C – 600°C)
Modulation	Direct FM	Direct FM
Deviation (Modulation Limiting)	\pm 5.0 kHz	\pm 5.0 kHz
Spurs & Harmonics (dBm)	< -20 dBm	< -13 dBm
FM Hum & Noise	- 50 dB	- 50 dB
Adjacent Channel Power	60 dBc	60 dBc
Radiated Spurious Emissions	< -20 dBm	< -13 dBm

Product Specifications	UHF 25 KHz	UHF 12.5 KHz
Receiver		
Frequency Range (MHz)	465 – 470 Mhz	465 – 470 Mhz
Receiving System	Programmable	Programmable

Product Specifications	UHF 25 KHz	UHF 12.5 KHz
Frequency Stability	+/- 1.0 PPM (-300°C – 600°C)	+/- 1.0 PPM (-300°C – 600°C)
Audio Frequency	300 Hz to 3 KHz	300 Hz to 3 KHz
Sensitivity (12 dB SINAD)	- 119 dBm (0.25 uV)	- 119 dBm (0.25 uV)
Selectivity (Adjacent Channel Selectivity)	- 75 dB	- 70 dB
Intermodulation Rejection	- 70 dB	- 70 dB
Spurious Response Rejection (blocking 1 Mhz)	- 90 dB	- 90 dB
Radiated Spurious Emissions (< 1 GHz)	- 54 dBm	- 54 dBm
Radiated Spurious Emissions (< 1 GHz)	- 52 dBm	- 52 dBm
Input impedance	50 Ohms	50 Ohms

810 Military Standards (1)	RPX Repeater 4 W –UHF 450 – 470 MHz	
	METHOD	PROCEDURE
<i>810 - C</i>		
Low Pressure	500.1	1
High Temperature	501.1	1, 2
Low Temperature	502.1	1
Temperature Shock	503.1	1
Solar Radiation	505.1	1

810 Military Standards (1)	RPX Repeater 4 W –UHF 450 – 470 MHz	
	METHOD	PROCEDURE
Rain	506.1	1, 2
Humidity	507.1	2
Salt Fog	509.1	1
Dust	510.1	1
Vibration	514.1	8, 10
Shock	516.1	1, 2, 5
810 - D		
Low Pressure	500.2	2
High Temperature	501.2	1, 2
Low Temperature	502.2	1, 2
Temperature Shock	503.2	1
Solar Radiation	505.2	1
Rain	506.2	1, 2
Humidity	507.2	2, 3
Salt Fog	509.2	1
Dust	510.2	1
Vibration	514.3	1
Shock	516.3	1, 4

810 Military Standards (1)	RPX Repeater 4 W –UHF 450 – 470 MHz	
	METHOD	PROCEDURE
<i>810 - E</i>		
Low Pressure	500.3	2
High Temperature	501.3	1, 2
Low Temperature	502.3	1, 2
Temperature Shock	503.3	1
Solar Radiation	505.3	1
Rain	506.3	1, 2
Humidity	507.3	2, 3
Salt Fog	509.3	1
Dust	510.3	1
Vibration	514.4	1
Shock	516.4	1, 4

Other Product Specifications	UHF 25 KHz	UHF 12.5 KHz
Li-On Battery Solution	Available as an accessory	Available as an accessory
Alkaline Battery Frame Solution	Yes	Yes
Dimensions (x W X D) (inches):	4.7 H x 7.4 W x 2.0 D	4.7 H x 7.4 W x 2.0 D

Other Product Specifications	UHF 25 KHz	UHF 12.5 KHz
Weight		
Repeater with Alkaline Frame	2.1 lbs	2.1 lbs
Repeater with Li-On Frame	2.0 lbs	2.0 lbs
Average Battery Life @ 100% duty (20%/80% operation):		
With Alkaline Frame	16 Hours	16 Hours

810 Military Standards ⁽¹⁾	RPX Repeater 4 W –UHF 450 – 470 MHz	
	METHOD	PROCEDURE
<i>810 - C</i>		
Low Pressure	500.4	1
High Temperature	501.4	1, 2
Low Temperature	501.4	1, 2
Temperature Shock	503.4	1
Solar Radiation	505.4	1
Rain	506.4	1
Humidity	507.4	3
Salt Fog	509.4	1

810 Military Standards ⁽¹⁾	RPX Repeater 4 W –UHF 450 – 470 MHz	
	METHOD	PROCEDURE
Dust	510.4	1
Vibration	514.5	1
Shock	516.5	1
Environmental Specifications		
Operating Temperature	-30°C to + 60°C (Radio)	-30°C to + 60°C (Radio)
Sealing ⁽²⁾	IP55	IP55
Shock & Vibration	Polycarbonate Housing passes EIA 603	
Dust & Humidity ⁽³⁾	Satisfied EIA 603	

⁽¹⁾ MIL STD 810 C, D, E, and F, have blowing rain of sections that call out the device shall survive subsection to 30 minutes of a 4 inch/hour in a 40 mph wind. Dust section calls out blowing dust around 11ug/m³ for 6 hours.

⁽²⁾ IP55 means the enclosure is dust protected. It also means it is water protected as if jet of water were sprayed by a hose (3 gal/min for at least 3 minutes).

⁽³⁾ Relative Humidity (RH) is 95% at a -30°C to 60°C.